Heavy rain prediction applying satellite-based cloud data assimilation over land

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For accurate flood prediction, warning systems, and optimized dam control, information of positional relationship between rain areas and river basins is crucial. This requires very fine precision in the prediction of rainfall areas. Assimilation of satellite-based microwave observation of cloud has great potential to improve precipitation areas because it can directly obtain information on rainfall locations as well as amount of cloud. However, it is difficult to observe clouds over land using satellite microwave remote sensing, because land emissivity is much stronger and more heterogeneous than that of cloud. To overcome this challenge, appropriate representation of heterogeneous land emissivity is needed. Thus, We developed a Coupled Atmosphere and Land Data Assimilation System with the Weather Research and Forecasting model (CALDAS-WRF), which can assimilate soil moisture, cloud water content over land, and heat and moisture within clouds simultaneously. Results of application of CALDAS-WRF to heavy rain events show that the system effectively assimilated cloud signals and produced very accurate cloud and precipitation distributions with appropriate intensity. Also, the local atmospheric fields are modified appropriately around the area of assimilated clouds. Furthermore, by using operationally analyzed dynamical and moisture fields as initial and boundary conditions, the system improved prediction of precipitation duration. The results demonstrate the method’s promise in dramatically improving predictions of heavy rain and consequent flooding.

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